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File 605
T.O. 8
CSR

25X1

[redacted]

ILLEGIB

(IN TRIPLICATE)

5 January 1961

25X1

[redacted]

Attention: [redacted]

Subject: Contract No. 605
Task Order 8
Extension of Task Order Delivery
Date, Request for

25X1

Gentlemen:

After a careful review of the status of the equipment being built on the subject task order, the contractor respectfully requests an extension of the present delivery date from 14 January 1961 to 14 April 1961.

The above extension has been necessitated by the following:

The electromagnetic horn antenna and waveguide assembly for use in the 10,000 mc to 40,000 mc frequency range was found to operate in an unsatisfactory manner when loaded with a dielectric slab of high dielectric constant (E_r = 14).

Though theoretically and actually it is possible to manufacture a dielectric slab which will give satisfactory system performance over the frequency range 10,000 mc to 40,000 mc, it is not practically possible to manufacture two or more slabs which will give reasonably similar results. The reason for this is the minute differences in physical characteristics of the dielectric slabs. The pattern deterioration (radiation pattern splitting) is most evident above 30,000 mc where the second order mode is easily excited by any asymmetries in the dielectric slab. The effect of any asymmetry is magnified in proportion to the magnitude of the dielectric constant, therefore, the redesign which is explained later will incorporate a dielectric slab of lower dielectric constant.

The purpose for loading the horn antenna and waveguide assembly with a dielectric slab is to broadband the antenna system. Ordinarily, the antenna operates over the frequency range 33,000 mc to 50,000 mc and has a lower cutoff frequency at 26,500 mc, thus providing the first desired frequency range 30,000 mc to 40,000 mc with normal radiation characteristics.

The second desired frequency range is 20,000 mc to 40,000 mc and is obtained by inserting into the horn and waveguide assembly a plexiglass slab, the dielectric constant of which is approximately 2.6. Satisfactory radiation characteristics are obtained by careful shaping of the portion of the plexiglass slab which extends into the throat of the horn. Small irregularities in the walls of the horn antenna and waveguide assembly are of minor consequence to the successful operation of the antenna system over this frequency range and calibrated results are readily obtained. At present there is no evidence of calibration change when the plexiglass slab is exposed to normal wear and handling.

When the horn antenna and waveguide assembly is loaded with a dielectric slab (dielectric constant approximately 14.0) to provide the third desired frequency range 10,000 mc to 40,000 mc the radiation characteristics change and as a direct consequence the sensitivity of the system deteriorates. This deterioration in system performance is readily observed as the radiation patterns in the frequency range 32,000 mc to 40,000 mc begin to split into two or more major lobes. This phenomenon is caused by having loaded the horn and waveguide assembly with a dielectric slab with high dielectric constant and with asymmetries due to normal manufacturing tolerances, thus exciting higher order modes in the antenna and detector system. The manner in which the beam splitting occurs is necessarily unpredictable and uncontrollable since very small (of the order of 10,000ths of an inch) variations or changes in the physical configuration of the dielectric slab may cause the antenna pattern to deteriorate in this upper frequency range. The on axis degradation in directivity (and consequently the system sensitivity) may vary from 3 db to 12 db approximately. The split pattern maxima will be degraded by approximately 3 db to 6 db depending upon the degree of pattern deterioration.

In order to provide satisfactory coverage of the three frequency ranges desired, a major redesign of the antenna and waveguide assembly is deemed necessary. The frequency coverage will be accomplished in the following manner: The antenna and waveguide will operate under normal conditions from 20,000 mc to 40,000 mc with a cutoff frequency of 17,000 mc. Operation from 30,000 mc to 40,000 mc will be obtained by inserting a section of waveguide with a cutoff frequency at 26,500 mc into the waveguide used for the 20,000 mc to 40,000 mc frequency range. A dielectric slab with a dielectric constant as low as 4.0 may then be utilized for extending the operation of the system from 10,000 mc to 40,000 mc. Because the dielectric constant is smaller than in the original system the small irregularities in the slab will not be as detrimental.

The redesign of the antenna and waveguide assembly has become imperative if satisfactory operation over the three desired frequency ranges is to be obtained.

A review is being made at this time to determine whether additional funds will be required to complete the subject task order as the result of the above major redesign. It is expected that the results of this review will be forwarded to the buyer in approximately two weeks.

Prompt attention to the above request will be appreciated.

Very truly yours,

Contract Administrator

NKG:dw